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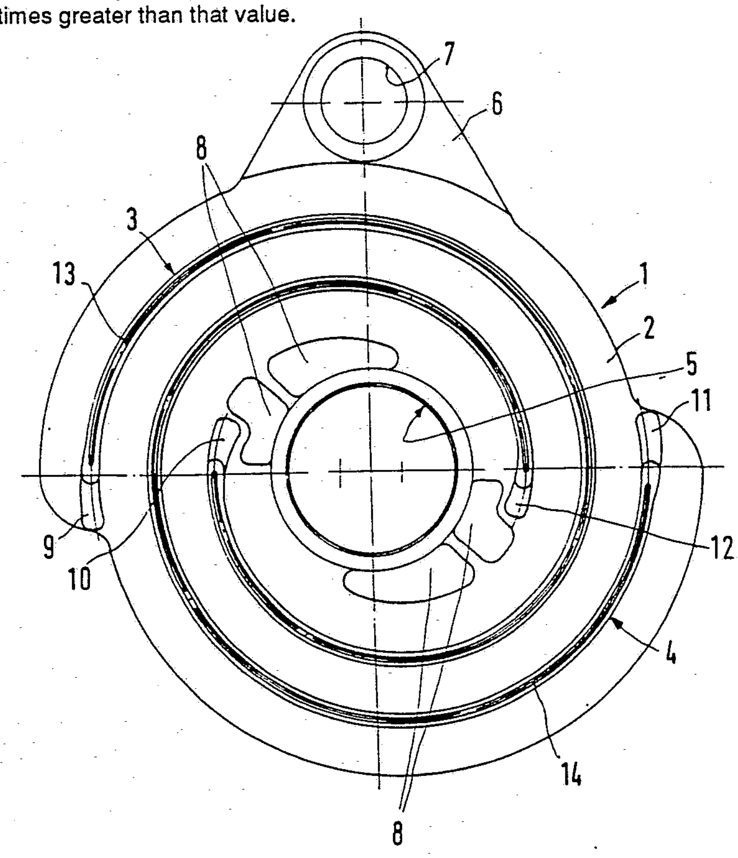
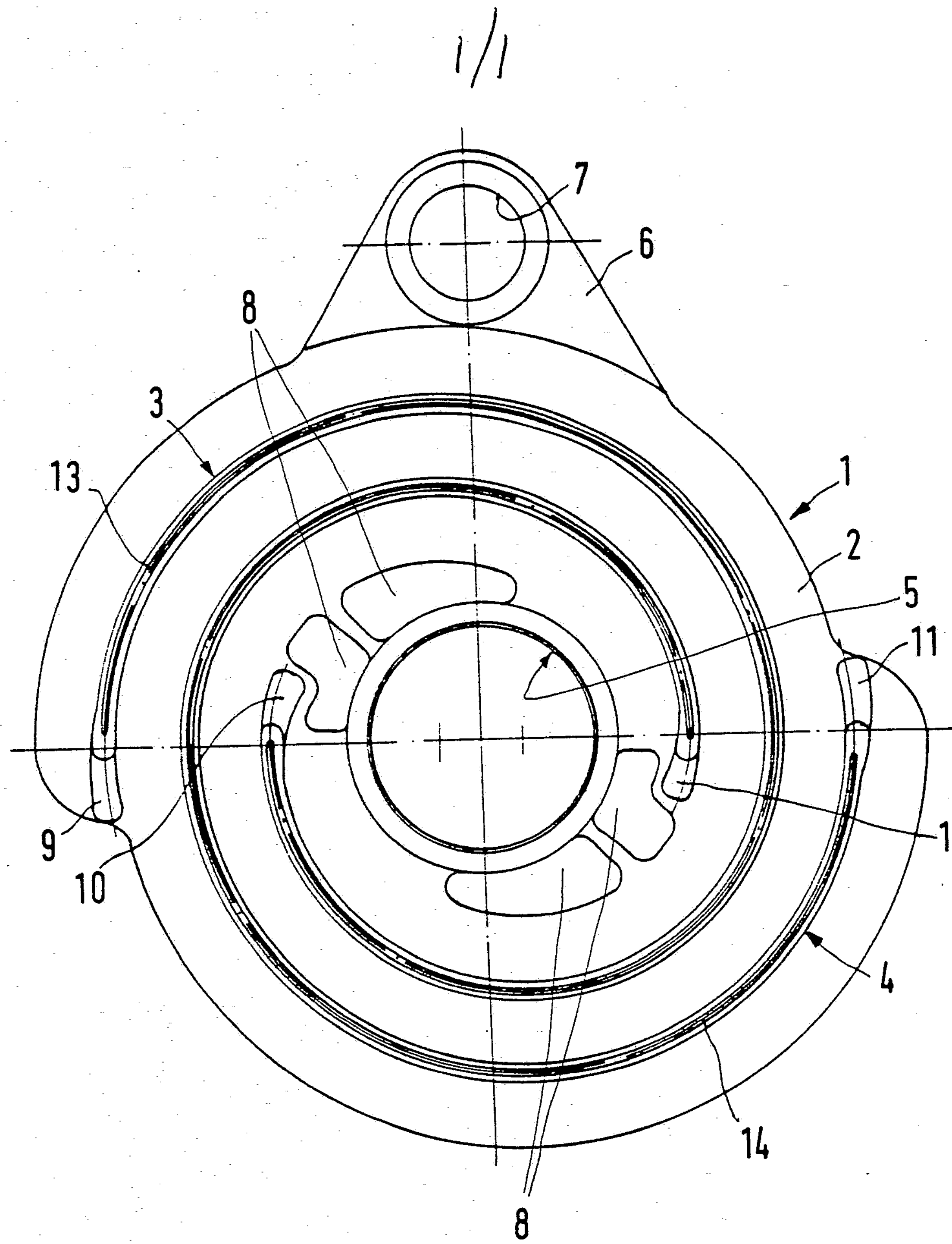
F01C F04C

(54) Displacement machine for compressible media

(57) The machine comprises at least one displacement chamber disposed in a stationary housing and in the form of a spirally extending slot wherein strip or rib-like spiral housing walls of substantially uniform radial thickness are provided. Displacement members 3, 4 in the form of spiral-shaped strips or ribs of substantially uniform thickness and each associated with a respective displacement chamber are each held substantially at right angles on a disc-shaped rotor 1 which is drivable eccentrically relative to the housing. In order to increase the rigidity of shape of the strip or rib-like displacement members 3, 4 or of the housing walls, their radial thickness in the region of their circumferential ends 9 to 12 is increased. As shown the radial thickening is provided on a particular side of the displacement members or housing walls and is increased from value corresponding to the uniform section of the displacement members or housing walls, to approximately 1.1 to 2 times greater than that value.

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DESCRIPTION

DISPLACEMENT MACHINE FOR COMPRESSIBLE MEDIA

The present invention relates to a displacement machine for compressible media.

A displacement machine of this type is disclosed in German Offenlengungsschrift No. 31 07 231. Such machines are distinguished by their provision of a substantially pulsation-free delivery of gaseous working medium, preferably comprising air or a mixture of air and fuel, and hence may advantageously be used, inter alia, for the purpose of charging internal combustion engines, especially those provided for passenger vehicles. In such a displacement machine, acting as a pump or compressor, several approximately crescent-shaped working chambers are enclosed along each displacement chamber. These working chambers are defined by the spiral-shaped displacement members and the two circumferential walls of the displacement chambers, particularly as a result of different curvatures of the spiral displacement members and the spiral displacement chambers. During operation of the machine, the crescent-shaped working chambers move through the displacement chambers from a working medium inlet, disposed in a radially outer region, to a working medium outlet, disposed in a radially inner region. The volume of the working chambers may also be constantly decreased during this movement, and hence the pressure of the working medium may be correspondingly increased.

The displacement members are formed by spiral-shaped strips or ribs attached to a disc-shaped rotor and are relatively long in an axial and a circumferential direction compared with their radial thickness. The axis of the spiral-shaped strips extends substantially at right angles to the plane of the rotor. Similarly, with respect to the housing, stationary spiral-shaped chamber walls are provided in the form of strips or ribs, which are relatively long in an axial and circumferential direction compared with their radial thickness. As a result of this configuration, the end edges of the strips or ribs are relatively unstable, particularly in their region furthest from the rotor disc, or the bottom of the housing, so that they may bend during operation of the displacement machine and may therefore contact adjacent components. Furthermore, considerable stresses occur, especially in the base region of these end edges of the strips, which may lead to the fracture thereof. These relatively unstable displacement members and housing walls also experience vibrational problems during manufacture.

The present invention seeks to provide a displacement machine in which the aforementioned disadvantages are avoided and the spiral-shaped strips or ribs provided on the rotor and in the housing, have a greater rigidity, especially in their end regions.

In accordance with the present invention there is provided a displacement machine for compressible media, having at least one displacement chamber disposed in a stationary housing, which at least one displacement chamber is in the form of a spirally extending slot, wherein strip or rib-like spiral housing walls of substantially uniform radial thickness are provided for the at least one displacement chamber, and further having displacement members in the form of spiral strips or ribs of substantially uniform radial thickness, each of which displacement members is associated, and engages with, a respective displacement chamber and is held substantially at right angles on a disc-shaped rotor which is drivable eccentrically relative to the housing, the radial thickness of the displacement members and of the housing walls is increased in the region of the ends located in a circumferential direction.

This thickening of the ends of the ribs is advantageously provided over the entire axial height or length, and results in substantially improved rigidity of the components in their end regions, which regions are particularly unstable. The risk of contacting adjacent parts of the displacement machine during operation is therby reduced, and the ease of manufacture of the parts is facilitated by reducing the probability of vibration.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawing which is a plan view of one embodiment of a rotor of a displacement machine in accordance with the present invention.

The rotor 1 comprises a rotor disc 2 which is held between two housing halves (not shown) and is driven eccentrically in such a way that every point on it performs a circular displacement movement in the plane of the rotor disc. Displacement members 3 and 4 in the form of spirally extending strips or ribs are held on at least one face of the rotor disc 2, preferably on both sides thereof. Two interengaging displacement members are illustrated in the embodiment shown in the drawing. These strip or rib-like displacement members 3,4 extend over a circumferential region, of the rotor 1, of approximately 360°C. The respective ends of the two displacement members are offset by approximately 180°C relative to one another.

Each displacement member 3,4 has an associated displacement chamber (not illustrated in the drawing) incorporated in the form of a spiral slot in the stationary housing. Each displacement chamber extends from an inlet chamber provided on the outer periphery of the housing to an outlet chamber provided on the inner periphery, and has substantially parallel, spiral-shaped walls spaced at a uniform distance apart and between which the strip or rib-like displacement members 3,4 of the rotor engage. The curvature of each spiral-shaped displacement member is dimensioned in such a way that the displacement member almost touches the inner and outer chamber walls of the housing at a plurality of points, for example at two points in each case, so that in each case a plurality of crescent-shaped working chambers are formed between the chamber walls and the displacement member and, during operation of the displacement machine, the crescent-shaped working chambers are displaced through the displacement chambers in a circumferential direction from the inlet chamber to the outlet chamber.

The spiral shape of the displacement members or of the displacement chamber walls need not comprise a spiral as defined in the strictly mathematical sense but, alternatively, may be realised by a plurality of contiguous arcs of decreasing radii.

As is shown in the drawing, the rotor disc 2 has a first bearing bore 5 in its centre, and a second bearing bore 7 in a bearing lug 6 mounted on the outer periphery of the rotor disc 2. These bearing bores serve to receive bearings, or drive journals, for providing the eccentric drive of the rotor disc 2. The outlet chambers of the housing halves, provided on both sides of the rotor disc 2, are connected by way of openings 8 in the radially inner region of the hub of the rotor disc. Spiral-shaped grooves 13 and 14 extending in a circumferential direction are provided on the faces of the strip or rib-like displacement members 3,4 for the purpose of receiving sealing strips of appropriate shape.

In order to improve the stability of the rounded end edges of the strip or rib-like displacement members 3,4 the radial thickness of these end regions 9,10 and 11,12 is increased, relative to the remaining regions, both at the inlet side and the outlet side. For each displacement member, this thickening is provided only on the side of the displacement member remote from the adjacent displacement member. Thus, the strip-like displacement members 3 and 4 are thickened, radially outwardly, at their radially outer ends 9 and 11 respectively, while the contour of the inside of the end region of the displacement member corresponds to the remaining shape of the wall of the displacement member. Alternatively, the inner ends 10 and 12 of the displacement members are thickened in the direction of their inner side. The reason for this is that the chamber walls of the housing, which co-operate with these regions of the displacement members, may also only be corrected towards these sides without impairing the other regions of the displacement chambers. That is, the walls of the displacement chambers operate as envelope curves of the contours of the displacement members during the eccentric motion of the rotor 1.

As can be seen from the drawing, the end regions of the displacement members may be thickened from an initial value corresponding to the thickness of the uniform portion of the displacement members, to a final value which is, for example, 1.1 to 2 times, preferably 1.3 to 1.5 times, greater than this value. This region of thickening of the displacement members may extend over an angular segment approximately not greater than 30°.

Advantageously, the end regions of the strip or rib-like displacement members are thickened uniformly over their entire axial height or length. However, it is additionally possible for the end edges lying in a circumferential direction to have an oblique or curved shape, as has already been proposed in German Offenlengungsschrift No. 35 35 309.

It is also possible to thicken, in a radial direction, the end regions of the stationary housing walls, located between the displacement chambers in the housing of the displacement machine and which are likewise in the form of spiral-shaped strips or ribs. Such an increase in thickness in a radial direction in this region is generally only necessary when the end regions of the housing walls are self-supporting, which may not always be the case in, for example, the radially outer region.

The main advantage of the thickening of the end regions of the displacement members or of the housing walls, resides in the substantial increase in the rigidity of these ribs or strips, which are relatively unstable due to their relatively large axial height or length and circumferential length, so that the probability of contact between adjacent components, and hence the probability of the displacement machine becoming damaged, is reduced.

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CLAIMS

1. A displacement machine for compressible media, having at least one displacement chamber disposed in a stationary housing, which at least one displacement chamber is in the form of a spirally extending slot, wherein strip or rib-like spiral housing walls of substantially uniform radial thickness are provided for the at least one displacement chamber, and further having displacement members in the form of spiral strips or ribs of substantially uniform radial thickness, each of which displacement members is associated, and engages with, a respective displacement chamber and is held substantially at right angles on a disc-shaped rotor which is drivable eccentrically relative to the housing, the radial thickness of the displacement members and of the housing walls is increased in the region of the ends located in a circumferential direction.

2. A machine as claimed in claim 1, wherein the radial thhickness of the housing walls does not increase in the region of the ends located in a circumferential direction.

3. A machine as claimed in claim 1, wherein the radial thickness of the displacement members does not increase in the region of the ends located in a circumferential direction.

4. A machine as claimed in claim 1 or 2, wherein the displacement members are radially thickened on the side of their end regions remote from the adjacent displacement members.

5. A machine as claimed in claim 1 or 3, wherein the housing walls are radially thickened on the side of their end regions remote from the adjacent housing walls.

6. A machine as claimed in any of claims 1,2 or 4, wherein the radial thickness of the end regions of the displacement members increases continuously from an initial value corresponding to a uniform section of the displacement members, to a final value.

7. A machine as claimed in any of claims 1,3 or 5, wherein the radial thickness of the end regions of the housing walls increases continuously from an initial value corresponding to a uniform section of the housing walls, to a final value.

8. A machine as claimed in claim 6 or 7, wherein said final value is between 1.1 and 2 times greater than said initial value.

9. A machine as claimed in claim 8, wherein said final value is between 1.3 and 1.5 times greater than said initial value.

10. A machine as claimed in any one of the preceding claims, wherein the thickening is effected over an angular segment less than 30°.

11. A displacement machine for compressible media substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

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